

# EFFECTIVENESS OF HEUTAGOGY INTEGRATED E-CONTENT MODULES ON UNDESTANDING OSMOSIS AMONG SCIENCE STUDENTS IN COLLEGES OF EDUCATION IN SRI LANKA

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## ABSTRACT

*The learning teaching process has undergone a paradigm shift in recent years. It has shifted from teacher centred to student centred. Hence, the challenge of a teacher has become as to how to cater to the needs of all types of learners in the classroom when their learning styles vary according to their individual needs.*

*Heutagogy is a technique of self-determined learning with practices and principles rooted from andragogy that could be responsible for the developments in higher education. This technique coupled with e-content is an innovative strategy that provides multi-sensory experience to the learners. The learners can visualize the entire content and attain mastery over the topics. In the present study, the e-content on osmosis was developed and given to the tertiary learners for learning. Pre-test and post-test were administered to the samples to ascertain the effectiveness of heutagogy integration into e-content. The results of the study revealed that e-content with heutagogical approach for learners of higher education were effective.*

**KEY WORDS:** *Heutagogy, Effectiveness, e-content, osmosis.*

## 1. INTRODUCTION

The learning teaching process has undergone a paradigm shift in recent years. It has got changed from teacher centred to student centred. A large number of new techniques are adopted for effective learning teaching process. In this backdrop, heutagogy, a *self-determined learning is coupled with e-content*. It applies a holistic approach in developing learner capabilities, with learning as an active and proactive process (Jazeel and Saravanakumar, 2015). It is initially conceptualized as a natural extension to pedagogy and andragogy by taking into account the increasing complexity of learning and the corresponding implications for the role of the learner (Hase and Kenyon, 2000).

In a heutagogical approach to teaching and learning, learners are highly autonomous, have increased responsibility and self-determined and emphasis is placed on development of learner capacity and capability with the goal of producing learners who are well-prepared for the complexities of today's workplace (Lisa, 2012) and the learners acquire both competencies and capabilities (Stephenson, 1994, Kenyon, 2007).

According to Bangura (2005) heutagogy helps students develop confidence and competence, and to question interpretations of reality different from their own. It places the power in the hands of the learner and looks to a future where knowing how to learn will be a fundamental educational skill.

A key concept in heutagogy is *double-loop learning* and self-reflection (Argyris & Schon, 1996). In double-loop learning, learners consider the problem and the resulting action and

outcomes, in addition to reflecting upon the problem-solving process and how it influences the learner's own beliefs and actions. Double-loop learning occurs when learners "question and test one's personal values and assumptions as being central to enhancing learning how to learn" (Argyris and Schon, 1978).

In self-determined learning, it is important that learners acquire both competencies and capabilities (Stephenson, 1994, Hase & Kenyon, 2007). Competency can be understood as proven ability in acquiring knowledge and skills, while capability is characterized by learner confidence in his or her competency and as a result, the ability to take appropriate and effective action to formulate and solve problems in both familiar and unfamiliar and changing settings (Cairns, 2000). In the process of double-looping, learners become more aware of their preferred learning style and can easily adapt new learning situations to their learning styles, thus making them more capable learners (Jazeel and Saravanakumar, 2013). With its dual focus on competencies and capability, heutagogy moves educators a step closer toward better addressing the needs of adult learners in complex and changing work environments (Bhoryrub et al., 2010).

More mature learners require less instructor control and course structure and can be more self-directed in their learning, while less mature learners require more instructor guidance and course scaffolding (Canning & Callan, 2010; Kenyon & Hase, 2010). Education professionals have found heutagogy to be a credible response to the critical issues that their learners are faced with in the workplace and have designed their learning environments based on the approach (Bhoryrub et al., 2010; Ashton & Newman, 2006; Gardner et al., 2007).

Selection of the topic for the development of e-content has its own significance in any

subject in general and science in particular. As far as science subject is concerned, unless a teacher provides opportunity for a student to visualize certain topics in science, the student finds very difficult to master the ideas behind those contents. Science involves explaining abstract concepts and call for visualization of microscopic objects / organisms or gigantic processes. These challenges are met effectively by using graphics, animations and simulations on computers.

According to recent views of the academics teaching biology at the Arts and Science College, many undergraduate students who study biology find it difficulties in understanding osmosis. The integrating of heutagogy with e-content is suggested by these academics for learning process of osmosis. Review of literature revealed there is little research on this topic and even they did not focus the undergraduates. Therefore, this study was planned.

## 2. OBJECTIVES OF THE STUDY

- To develop e-learning modules in osmosis
- To find out the effectiveness of the e-learning modules integrated heutagological approach in osmosis
- To make recommendations based on the findings of the study

## 3. HYPOTHESES OF THE STUDY

1. There is significant difference in the pre-test mean score between Control group and Experimental Group.
2. There is significant difference in the pre-test and post-test mean scores in Control group.
3. There is significant difference between the pre-test and post-test mean score of Control group and Experimental Group based on gender.

## 4. METHOD OF THE STUDY

### Design of the study

In this study, an experimental research method with pretest - posttest two group design was adopted.

### Sample of the Study

Investigator selected 20 final year science students from Addalaichenai College of Education, in Sri Lanka for the present study. The sample was selected at based on their last term test on science and made into two equal group.

### Population of the Study

The population of the study constitutes all the science students studying at colleges of Education in Sri Lanka.

### Tools for the Study

1. Achievement type Pretest and posttest on understanding of osmosis
2. E-content modules

The e-content developed was validated by the experts in educational technology and science. The pretest and posttest were validated through test retest method.

The pre-test was conducted for all 20 students (both control and experimental groups). The control group received conventional method of teaching while the experimental group were exposed to e-learning module. The investigator successfully controlled the external threats to the study.

Apart from the experimentation, the experimental group students were asked to self-reflect the process of their learning in order to ascertain their style of learning since the heutagological approach was adopted in this study. PGRMT (Planning, Goal setting, Reflection, Measurable outcome and Time management) method was adopted to self-reflect their learning.

### The development of e-content modules

**Designing of e-content:** In the present study, the investigator decided to develop the e-content in HTML format based on the objectives. In this stage, the topic divided into sub topics. Appropriate images, animations, and videos were collected.

**Script writing for video:** The investigator prepared the script were the message were carefully planned and sketched out. The audio part of the script was what would be said and what sound effect would be recorded. The 'visual' part of the script shows every shot that will be used in the final production.

**Story Board for Video:** The first step of the video shooting, the investigator prepared a story board, which is the working document of video in the e-content. The investigator used three column formats for story board writing. In this format the first column contains content part, second column contains proposed visuals, and the third column contains effect for e-content.

nice the content is given to the students for self-learning all the contents like objectives, glossary, script, story board, video, related links, quiz for evaluation were given in the

module. The e-content was validated by using expert validation

## 5. RESULTS AND DISCUSSION

The testing of the hypothesis from analysis of the post test and pre-test scores between control and experimental groups has revealed the following results.

### Null Hypothesis:

There is no significant difference in the pre-test mean score between Control group and Experimental Group.

**Table 1 Showing Mean scores of Control Group in the pre-test**

Control group	N	Mean Pretest	SD	't' value
Pre-test	10	9.50	0.707	37.40
Post-test	10	47.00	3.900	

From the table it may be inferred that, since the t value obtained 37.40 is more than the table value 2.89. The difference in mean pretest between control and experiment group is significant at 0.01 level. Thus, the null hypothesis of the Study has been rejected. Thus, there is significant difference in the pre-test mean score between Control group and Experimental Group.

### Null Hypothesis:

There is no significant difference in mean scores between pre-test and posttest in Experimental Group.

**Table 2: Mean scores of Experimental group in the pre-test and post-test**

Experimental group	N	Mean Post test	SD	't' value
Pre-test	10	12.1	1.287	30.16
Post-test	10	60.0	6.272	

From the table it may be inferred that, since t the value obtained 30.16 is more than the table value 2.89 the difference in performance between the Pre-Test and Post-Test is significant at 0.01 level. Thus, this hypothesis has been confirmed. There is significant difference in mean score between pre-test and post-test in Experimental Group.

**Table 3: Mean scores of pre-test and post-test in Control Group and Experimental group on gender**

Group		N	MEAN	SD	't'Value
Control Group Pre-test	Male	6	9.33	0.516	0.904
	Female	4	9.75	0.957	

Post-test	Male	6	47.0	3.033	0.883
	Female	4	49.25	5.123	
Experimental Group Pre-test	Male	5	11.40	1.342	1.980
	Female	5	12.80	0.837	
Post-test	Male	5	56.80	7.050	1.804
	Female	5	63.20	3.633	

It can be seen from the table that the calculated 't' value is greater than that of the table value at 0.01 level of significance. Hence their post-test mean scores outnumber the pre test scores. This clearly shows that the e-content delivered its goods for the better performance of all the 10 students.

It is also inferred from the above table that the female students performed well compared to the male students. Thus, e-content is effective and it can enhance the knowledge and understanding of the students as it is developed with combinations of text, audio, animation, images, video and pedagogical applications which are blended to visualize the content.

All the ten students have planned before they start learning. Goal setting was also done by everybody. Regarding reflection 7 students were able to reflect based on the goal setting. 8 students out of ten were able to measure their progress remaining two were not able measure their progress exactly. All the 10 students were able to manage their time well.

## 6. RECOMMENDATIONS

The following recommendations are given based on the findings and conclusions

- Develop a partnership between educational institutions and IT industry for the continuous development of new content and methodology taking into account contemporary technology.
- Distribution of the e-content to teachers and students from formal and non-formal educational modes, for supplementing and complementing the process of teaching and learning in higher education.
- Self-reflection training to be given to students for better learning in heutagogical approach.
- Laboratory demonstration like dissection of plants and animals can also be taught through multimedia so that no animal or plant has to sacrifice its life.

## 7. CONCLUSION

The best way to help students become future ready is to guide them towards becoming self-determined in their learning. E-Content encourages open-minded, reflective, critical and active learning. With e-content materials, the learner and teacher will understand that he or she is changing from a provider of facts to the one who facilitates a learning environment. It is in this assumption that this investigation attempts to devise an innovative teaching technique through e-content approach. Humans can integrate information from different sensory modalities into one meaningful experience. E-Learning modules are becoming an important tool for faculty in the biological sciences due to increasing conceptual and functional complexity that presents educational challenges that cannot be adequately addressed with traditional teaching methods (Buckley *et al.*, 1999). Heutagogical approach helps to learn science at a faster rate. In science subjects simulations of processes and experiments allow students to explore concepts in new ways, enabling students to become self-directed learners (Kozma, Chin, Russel & Marx, 2000).

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